PRINT SYSTEM, PRINTING METHOD, INFORMATION

PROCESSING APPARATUS, PRINTING APPARATUS,

PRINTER DRIVER, AND MEMORY MEDIUM

5   BACKGROUND OF THE INVENTION

Field of the Invention

The invention relates to a print system, a

printing method, an information processing apparatus, a

printing apparatus, a printer driver, and a memory

10   medium.

Related Background Art

Hitherto, a process by a printer driver and a

process by a printing apparatus are independently

executed. After instructions of a print mode, a page

15   margin, and the like are sent from the printer driver,

during the data generation on the printer driver side,

even if information which can be checked exists, the

printer apparatus is not particularly notified of the

information but only print data is sent. At this time,

20   the printer driver sends the data to the printing

apparatus in data processing order. For example, in

case of printing color/monochrome data (color data and

monochrome data exist mixedly), a printer main body

changes a printing method lest a blur is caused between

25   color/monochrome images.

However, in case of changing the printing method

in accordance with the print data which is sent in

order as in the conventional method, it is necessary that the printer main body starts to print after checking whether the color/monochrome data exists in the data or not.

5   That is, since the printer main body cannot check what kind of data will be subsequently sent, it receives the next data in a state where all cases are presumed preparing for the next data, checks contents of the sent data, and executes the print while

10   selecting an operation so as to perform the optimum print.

Therefore, the printer main body has to execute processes for reserving a surplus buffer for storing the data and analyzing the contents of the data before

15   the print, so that it takes a processing time. In case of the data existing over pages, whether data exists in the next page or not cannot be checked or in which print mode the next page is cannot be checked. Therefore, even if the same mode continues, it is

20   necessary to interrupt the processes once, wait until the end of the current print presuming a situation such that a buffer construction has to be changed when the print mode is changed to the next print mode, and, thereafter, execute the next printing operation.

25

SUMMARY OF THE INVENTION

It is, therefore, an object of the invention to

provide a print system, a printing method, an
information processing apparatus, a printing apparatus,
a printer driver, and a memory medium, in which in the
case where the printer driver can previously confirm

5   structure information of data during the data
generation, print efficiency can be raised by using the
confirmed structure information.

To accomplish the above object, according to the
invention, there is provided a printing method of

10   allowing a printing apparatus to print by using print
data which is sent by a printer driver which is made
operative by an information processing apparatus,
comprising the steps of: adding structure information
of the print data by the printer driver to the print

15   data which is sent; sending the added structure
information to the printing apparatus; and executing a
printing process of the print data by the printing
apparatus on the basis of the received structure
information.

20   Other features and advantages of the present
invention will be apparent from the following
description taken in conjunction with the accompanying
drawings, in which like reference characters designate
the same or similar parts throughout the figures

25   thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing a construction of a print system in the first embodiment;

Figs. 2A and 2B are diagrams each showing a construction of a print job which is sent to a printer 40 by a printer driver in comparison with a conventional construction;

Figs. 3A and 3B are flowcharts each showing a print processing procedure in the print system;

Fig. 4 is a diagram showing a specific example of structure information of data;

Fig. 5 is a perspective view of a printing apparatus;

Fig. 6 is a block diagram showing a construction of a control system of the printing apparatus;

Fig. 7 is a flowchart showing a procedure in the case where the structure information was obtained on the printer side;

Fig. 8 is a diagram showing nozzles of a head;

Fig. 9 is a flowchart showing a procedure for adding the structure information on the host (printer driver) side; and

Figs. 10A and 10B are diagrams each showing a construction of a print job which is sent to the printer 40 by the printer driver according to the second embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An embodiment of a print system, a printing method, an information processing apparatus, a printing apparatus, a printer driver, and a memory medium of the invention will now be described with reference to the drawings.

(First embodiment)

Fig. 1 is a block diagram showing a construction of the print system in the first embodiment. According to the print system, a host computer 20 and a printer 40 are connected via a network 60, and a print job which is sent from the host computer 20 is printed by the printer 40.

The host computer 20 has a CPU 21 for executing processes of a document in which figures, images, characters, tables (including a spreadsheet and the like), and the like exist mixedly on the basis of a document processing program stored in an ROM 23, or the like. The CPU 21 integratedly controls each device connected to a system bus 24. An operating system (hereinafter, abbreviated to "OS") as a control program which is executed by the CPU 21, and the like have been stored in the ROM 23.

An RAM 22 functions as a main memory, a work area, or the like of the CPU 21. A keyboard controller (KBC) 25 controls a key input from a keyboard (KB) 29 or a pointing device (not shown). A CRT controller (CRTC)

26 controls a display of a CRT display (CRT) 30. A
disk controller (DKC) 27 controls an access to an
external memory 31 such as hard disk (HD), floppy disk
(FD), or the like. A boot program, various

5   applications, font data, user files, edit files, a
character image data generating program, a printer
control command generating program (hereinafter,
referred to as a printer driver), and the like have
been stored in the external memory 31.

10   Reference numeral 28 denotes a printer controller
(PRTC) which is connected to the printer via a
predetermined bidirectional interface (interface or
I/F) and which executes a control process of
communication with the printer. In the embodiment,

15   however, a control process of communication with the
printer 40 or another computer connected to the network
60 such as an LAN via a bidirectional interface 51 is
executed by a network controller 32 (NETC).

        The printer 40 has a printer CPU 42. On the basis

20   of a control program stored in an ROM 43, the printer
CPU 42 outputs an image signal as output information to
a printer engine 47 via an engine interface 46
connected to a system bus 45.

        The control program and the like which are

25   executed by the CPU 42 have been stored in the ROM 43.
The CPU 42 can communicate with the host computer 20
via an input unit 48 and notifies the host computer 20

of information and the like in the printer. In the
embodiment, the CPU 42 can communicate with the host
computer 20, another computer, or another printer
connected to the network 60 such as an LAN from the
5   input unit 48 via a bidirectional interface 52.

The RAM 49 functions as a main memory, a work
area, or the like of the CPU 42. An external memory 44
is an IC card or the like and an access to it is
controlled by a memory controller (MC) 50. Switches
10   which are operated on the operation panel, an LED
display, and the like are arranged in an operation unit
41. Printer mode setting information can be stored
into the external memory 44 by using the operation unit
41.

15   Subsequently, generating and sending processes of
a print job in the print system having the above
construction will be described. Fig. 2A is a diagram
showing a construction of a conventional print job
which is sent to the printer 40 by the printer driver.
20   Fig. 2B shows a construction of the print job according
to the embodiment.

In Fig. 2A, reference numeral 101 denotes a
conventional print job which is sent to the printer by
the printer driver. Hitherto, the processes of the
25   printer driver and the processes of the printer are
independently executed. After instructions of the
print mode, page margin, and the like are sent from the

printer driver, during the data generation on the printer driver side, even if information which can be confirmed exists, the printer is not particularly notified of the information but only the print data is
5   sent.

Since the information regarding the print data is given only by a relatively large unit such as a page or the like, in order to use it for the actual print, the information is insufficient. Therefore, in order to
10   check a data structure more in detail, the printer accumulates a predetermined amount of the received print data, selects an optimum printing method while checking the data structure, and starts to print. Since such processes need a predetermined amount of
15   buffer and require a data process before printing, they become a load on the printer side.

In Fig. 2B, according to a print job 102 in the embodiment, data structure information (DSI) 103 is sent before the print data is sent. A data range (data
20   area) which designates the data structure information can be arbitrarily set. For example, the data area can be a block unit in which the data structure changes, a unit of a predetermined amount, a unit which is convenient when the printer driver recognizes the
25   information, or the like. If the data structure information 103 has been added to the print data, since it is sufficient that the printer uses the data

structure information 103, there is no need to newly analyze the data structure.

Figs. 3A and 3B are flowcharts showing a print processing procedure in the print system. In Fig. 3A, a printer driver program has been stored in the external memory 31 in the host computer 20 and is executed by the CPU 21. A print processing program in Fig. 3B has been stored in the ROM 43 in the printer 40 and is executed by the CPU 42.

On the host computer 20 side, when the printer driver starts to generate the print data (step S1), whether the data structure information could be checked during the generation of the print data or not is discriminated (step S2). If the data structure information cannot be checked, the processing routine is returned to the process of step S1 and the generation of the print data is continued. If the data structure information can be checked, the data structure information is sent to the printer 40 (step S3). Whether the generation of the print data has been finished or not is discriminated (step S4). If the generation of the print data is not finished, the processing routine is returned to the process of step S1 and the generation of the print data is continued. If the generation of the print data is finished, the print data is sent (step S5) and the processing routine is finished.

On the printer 40 side, when the data sent from the host computer 20 is received (step S11), whether the received data is the data structure information or not is discriminated (step S12). If it is the data structure information, the printer 40 prepares for printing on the basis of it (step S13) and waits until the print data is received. When the print data is received (step S14), the print is executed (step S15) and the processing routine is finished. If the received data is not the data structure information in step S12 but is the print data itself, the received print data is analyzed (step S16). The printer prepares for printing on the basis of an analysis result (step S17). After that, the print is executed in step S15 and the processing routine is finished.

Fig. 4 is a diagram showing a specific example of the data structure information. A case where print data 202, 203, 204, and 205 is arranged on a print paper 201 is now considered. In the first block, the host computer 20 first notifies the printer 40 of structure information 215 of the print data 202 in which color data and monochrome data exist mixedly. The structure information 215 shows that the color/monochrome data (color data and monochrome data exist mixedly) continues for a predetermined number of rasters. On the basis of the structure information 215, the printer 40 selects the optimum printing method

without analyzing the print data.

In the next block, the host computer 20 notifies the printer 40 of structure information 216 of the print data 203 in which only monochrome data continues. Further, in this block, since data exists only in a range (area) narrower than the right and left margins designated at the head of a page, such information is also notified. The printer 40 executes an efficient print on the basis of the structure information 216.

Further, in the next block, although the color print data 205 and the monochrome print data 204 exist on the same raster, they are not adjacent to each other. The host computer 20 notifies the printer 40 of structure information 217 including their contents, so that the printer separately executes the printing process with respect to the monochrome portion and the color portion without analyzing the data.

As data structure information, the following information can be mentioned: that is, information showing whether the print data is the color data or the monochrome data, whether the color data and the monochrome data are adjacent to each other or not, and the like; information showing from what number line from the present position the print data starts, from what number line the color data starts, from what number line the monochrome data starts, and the like; information regarding the right and left edges of the

print data; and the like.

According to the embodiment as mentioned above, for example, if the printer driver can preliminarily confirm the data structure information (information showing that with respect to the data of 20 lines after that, no color data exists, or the like) during the generation of the data, by sending this structure information to the printer, the printer can print without accumulating and analyzing the data.

Further, in a printer of a kind such that in the case where the print data is, for example, data of only monochrome data since a state of the preceding data has previously been known, the print data can be printed by the nozzles by increasing the number of nozzles which are used, a nozzle arrangement can be allocated from the beginning and the print can be efficiently performed.

By sending the data structure information prior to sending the actual data, the printer does not need to reserve a surplus buffer for the next data, and the print can be executed without analyzing contents of the data.

Although the case where the data structure information has been divided in accordance with the data construction has been shown and explained in the above embodiment, such a block unit can be arbitrarily set. For example, it can be set to a predetermined

interval or, if there is a surplus in the processes on the printer driver side, it is also possible to preliminarily analyze the whole page, divide it into optimum blocks, and issue an instruction. If there is

5   not a surplus in a partial process for the printer driver, only the print data can be also sent without adding the data structure information. In this case, with respect to the block without data structure information, the printer analyzes the data and starts

10   to print in a manner similar to the conventional one.

Fig. 5 is a perspective view of a printing apparatus according to the embodiment of the invention. In Fig. 5, a print head 502 is mounted on a carriage 501. The carriage 501 is guided by guide rails 503 and

15   504 and moves right and left. Reference numeral 505 denotes a roller portion for feeding a print medium 506. Reference numerals 507 and 508 denote marks serving as guides marked on the print head 502. These marks indicate a printing position where the print is

20   performed by the print head 502. For example, assuming that the print head 502 is an ink-jet head for printing by ejecting ink, the guides 507 and 508 function as indices of positions of print elements for ejecting the ink. Such guides 507 and 508 are used when the user

25   determines a print start position as will be explained hereinlater.

By constructing the printing apparatus in a manner

such that the print head 502 is provided with a lens in
place of the guides 507 and 508 or together with them,
and the print medium 506 can be seen from the printing
position of the print head 502 via the lens, it is also
possible to make such a construction useful for
determination of the print start position by the user
as will be explained hereinlater. The print head 502
can also construct an ink-jet cartridge together with
an ink tank.

Fig. 6 is a block diagram showing a construction
of a control system of the printing apparatus shown in
Fig. 5.

In Fig. 6, a CPU 100 executes a control process of
the operation of each section of the printing apparatus
shown, a data process, and the like. Its processing
procedure and the like have been stored in an ROM 100A.
An RAM 100B is used as a work area to execute the above
processes.

A print head 108 is, for example, an ink-jet print
head for ejecting ink, the ink ejection is performed by
a method whereby the CPU 100 supplies drive data and a
drive control signal of an electrothermal converter to
a head driver 108A. That is, a film boiling is caused
in the ink by a thermal energy which is generated by
the electrothermal converter, thereby allowing the ink
to be ejected from an ejection port. The CPU 100
further controls a carriage motor 70 for moving the

carriage 501 and a paper feed (PF) motor 80 for
rotating the roller portion 505 via motor drivers 70A
and 80A, respectively.

5   Fig. 7 is a flowchart showing a procedure in the
case where the structure information was obtained on
the printer side. When the structure information for
the next data is obtained in step S701, the CPU of the
printer prepares a buffer (or buffers) from color
information in accordance therewith (S702) and
10   determines an optimum paper feed amount and the optimum
number of nozzles which are used in consideration of
the positional relation of the color/monochrome data
(S703). If the structure information cannot be
obtained, the printer CPU first reserves the buffers
15   presuming that the data of all colors is sent (S704).
After that, the contents of the data are checked line
by line, the existence of the color/monochrome data is
checked, and the paper feed amount and the optimum
number of nozzles which are used are determined (S705).
20   If the information for the next data does not exist as
mentioned above, the printer CPU needs to reserve the
buffers in a state where all cases are presumed. In
case of the data in which, for example, only the
monochrome data exists for a plurality of lines after
25   that, the buffers reserved for color data are not
eventually used. On the other hand, if the fact that
no color data is included in the next data can be

previously confirmed by the structure information, the buffers for color data are not reserved but they are reserved as buffers for monochrome data, thereby enabling the finite buffers to be efficiently used. Also in the subsequent processes, if the structure information exists, the CPU can determine the paper feed amount and the optimum number of nozzles which are used by using the structure information. However, if there is no structure information, the CPU needs to check the data line by line and compute the optimum paper feed amount after that.

Further, whether information of a width of data has been added as structure information or not is discriminated (S706). If YES, in accordance with such information, the printer CPU can determine the right and left edges of the data and find a moving position of the head (S707). If the information is not added, contrarily, it is necessary that the right and left edges of the received data are first reserved buffer by buffer (S708), when the number of buffers which are used is decided by the determination of the number of nozzles which are used, the maximum width among the buffers is computed, and the moving position of the head is found (S709).

Fig. 8 is a diagram showing the nozzles of the head. Upon printing, a paper is moved upward from the bottom of the drawing. Numerals denote numbers

allocated on a unit basis of the buffer corresponding
to a unit of a plurality of nozzles. The long nozzles
on the right side correspond to the nozzles which are
used when the monochrome data is printed and the other

5   nozzles correspond to the nozzles for the color data of
each color, respectively. For example, if the data of
only black continues for the monochrome nozzles of Nos.
0 to 19 or more shown in the diagram, the print is
performed by using all of the monochrome nozzles. The

10   paper feed amount in this instance is determined so as
to feed the paper by a distance corresponding to the
number of monochrome nozzles in case of a print mode in
which the data is completed by one path. In case of a
print mode in which the data is completed by two paths,

15   the paper feed amount is decided so as to feed the
paper by the half distance of the above distance.

On the other hand, in case of printing a portion
of the color/monochrome data, the print is first
performed by using the monochrome nozzles of Nos. 12 to

20   19. After that, the paper is fed and at the point when
the color nozzles reach the position where the
monochrome image has been printed, the color data is
printed. By this method, a time difference is caused
between the print time of the monochrome data and that

25   of the color data, a blur is prevented, and print
quality can be improved. The procedure shown in Fig. 7
relates to processes for making such a discrimination.

Fig. 9 is a flowchart showing a procedure for adding the structure information on the host (printer driver) side. The printer driver detects information of the right and left edges of the data when a

5   compressing process of the data is executed or when a buffer size for reserving the data is found (S901) and adds the detected information as a command in order to notify the printer side of it (S902). Further, the printer driver checks whether the color data and the

10   monochrome data exist on the same line or not (S903) and also adds a check result as structure information (S904). Whether only the monochrome data continues or not is checked when the data is reserved in the buffer (S905). If it can be confirmed, information showing to

15   what number line of the next data the data of only black continues is added (S906) and the printer is notified of it. It is not always necessary that the above information has to be always added as structure information. If it is determined that the driver

20   cannot form the structure information due to a shortage of the buffer amount, a problem of a data processing time, or other factors, the processes can be also executed along a route shown by a dotted line (S907) shown in the flowchart without forming the structure

25   information. In this case, the printer side analyzes the data and prints in a manner similar to the conventional one.

(Second embodiment)

Figs. 10A and 10B are diagrams each showing a construction of a print job which is sent to the printer 40 by the printer driver in the second

5   embodiment. Since a construction of a print system is similar to that of the first embodiment, its description is omitted here.

As mentioned above, hitherto, as shown in Fig. 10A, even if there is information which can be checked

10   during the generation of the data, the printer driver does not particularly notify the printer of such information but sends only the print data. Therefore, since there is not next information showing by which construction the print data is sent, in order to check

15   the data structure, the printer 40 accumulates a predetermined amount of the received print data, selects the optimum printing method while analyzing the structure of the print data, and starts to print. According to such processes, since the buffers of a

20   predetermined amount are needed and the data processes before printing are necessary, they become a load on the printer side.

On the other hand, as shown in Fig. 10B, according to a print job 302 of the embodiment, prior to the

25   print data, structure information 303 of the next print data is sent. Sending timing of the structure information 303 can be set to arbitrary timing.

According to the second embodiment, when the structure
information 303 of the next print data is received,
particularly, if the structure information of the next
print data is concerned with the next page, for
example, in the case where information showing that the
data exists also in the next page and the print mode is
the same as the current mode is obtained, the printer
40 subsequently executes the present process and can
analyze the data without resetting it.

When the paper is ejected, since it has been
confirmed that the data exists in the next page, the
paper feeding operation is performed subsequently to
the paper ejecting operation, thereby making it
possible to prepare for printing the next page.

Further, even when the print mode of the next page
differs from that of the current page, with respect to
a portion such that the next page can be coped with, by
switching to the correspondence to the next page during
the present printing operation, processing efficiency
can be raised. On the other hand, if the occurrence of
an error such as an absence of the ink or the like
during the print of the next page can be predicted by
obtaining the information of the next page, it is also
possible to cause the error before the relevant page is
printed.

Further, even in case of the data existing over
the pages, if the data exists in the next page and,

further, if it is possible to determine that the next
print mode is a mode in which the print can be
continuously executed after the present print, the
print can be efficiently performed without causing a
5   vain waiting time.

Although the embodiments of the invention has been
described above, the invention is not limited to the
constructions of the embodiments but can be also
applied to any construction so long as it can
10   accomplish the functions shown by the scope of Claims
of the invention or the functions which the
constructions of the embodiments have.

For example, in the embodiments, although the
structure information has been sent block by block or
15   page by page prior to sending the print data, it can be
also sent simultaneously with the transmission of the
print data. Also in this case, the printer does not
need to analyze the structure of the print data but can
efficiently print it.

20   Naturally, the invention can be also applied to a
case where program codes of software to realize the
functions of the embodiments mentioned above are stored
into a memory medium and the program codes are read out
from the memory medium and supplied to a system or an
25   apparatus, thereby realizing the functions of the
embodiments. In this case, the program codes
themselves read out from the memory medium realize the

novel functions of the invention. The program codes
themselves and the memory medium in which the program
codes have been stored construct the invention.

In the embodiments, the program codes shown in the
flowcharts of Figs. 3A and 3B have been stored in each
of the memory media of the host computer 20 and printer
40. The memory medium to supply the program codes is
not limited to the ROM but, for example, a floppy disk,
a hard disk, an optical disk, a magnetooptic disk, a
CD-ROM, a CD-R, a DVD, a magnetic tape, a non-volatile
memory card, or the like can be used.

As many apparently widely different embodiments of
the present invention can be made without departing
from the spirit and scope thereof, it is to be
understood that the invention is not limited to the
specific embodiments thereof except as defined in the
appended claims.

According to the invention, if the printer driver
can previously check the data structure information
during the data generation, the printing efficiency can
be raised by using it. That is, when the data
structure information exists, the print is performed by
using it, and if there is no data structure
information, the print is performed while analyzing the
data, thereby enabling the print to be efficiently
executed.

Even in case of the print data existing over the

pages, if the print data exists in the next page and, further, if it is determined that the next print mode is a mode in which the process can be continuously executed after the present print, the print can be

5   efficiently performed without causing a vain waiting time.